The relative contribution of indigenous chicken breeds to poultry meat and egg production and consumption in the developing countries of Africa and Asia.

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In the almost complete absence of accurate in-country data on the relative production and consumption of eggs and meat from the different genotype groups, the approach reported here was to estimate production from indigenous scavenging flocks from published estimates on the proportion they comprised of the national flock, and on published reports on flock structure, productivity and egg management. Published estimates of the proportion of indigenous birds in the national flocks of the developing countries of Africa and Asia varied from 70 to 95%, with an average of about 80%. Despite comprising about 20% of the national flock, the contribution of indigenous hens to overall egg consumption was estimated to be quite small due to the widespread practice of allowing the hen to sit on and hatch most of the eggs laid. Due to this, and despite low growth rates and high mortality, the contribution of indigenous birds to overall chicken meat consumption was estimated to be near to 50% in some countries. The low input nature of scavenging chicken production systems in rural regions, and the widespread preference for the meat and eggs of indigenous birds, are together likely to ensure the retention of indigenous breeds for a considerable period of time to come. The study has highlighted the need for much more detailed and accurate in-country poultry statistics.

Keywords: Indigenous chicken production; family poultry

Introduction

The study reported here arose from the recognition of the importance and value of each country's animal genetic resources and the concern that the different species and breeds could contribute more than they currently do to food and agricultural production and meet much wider human needs. In the case of chickens in particular, there are concerns about the possible loss of genetic diversity as a consequence of a global reduction in the number of commercial breeders, and hence the number of commercial lines of birds (Shaver, 2000), and of the replacement through importation of traditional indigenous genotypes, particularly in developing countries, by the fewer retained hybrid commercial strains (Fourie *et al.,* 2004; Hoffmann 2005).

As a consequence of natural selection, under scavenging conditions indigenous breeds have been shown to be more disease resistant (e.g. Minga *et al.,* 2004) more capable of utilising low quality feed (e.g. Farrell *et al.,* 1999) and have a greater capacity for survival than the commercial hybrid strains (Horst, 1988; Sonaiya *et al.*, 1999). They could be reasonably expected to contribute positively to selection programmes based on productivity under local conditions, were such programmes to be initiated (Jain, 2004; Safalaoh and Sankhulani, 2004).

There would appear to be very considerable phenotypic diversity between the indigenous breeds/ecotypes of indigenous chickens across the regions of many of the developing countries (e.g. NAFRI, 2005; Moreki and Masupu, 2001; Kampeni, 2001; Bamhare, 2001; Buza and Hwamuhehe, 2001). Notwithstanding this, studies using microsatellite markers have suggested that genetic variation within chicken populations is lower than in other farm animals and humans. It is estimated that 50% of the chicken breeds registered with the FAO based Domestic Animal Diversity Information System (DAD-IS) are "at risk" (Scherf, World Watch list 2000)).

The impact of the contraction in commercial poultry breeding in developed countries, was considered outside the scope of this study, as it is essentially something that will be determined by private enterprise market forces alone. The continuing dramatic responses to selection for growth rate and meat production in commercial broiler lines (McKay *et al.* 2002) and for egg mass production in commercial layer lines (Besbes, 2002) suggests that, notwithstanding the finite genetic base of the nucleus lines involved, adequate genetic diversity remains to permit continued impressive gains in overall productivity. Changing consumer requirements have meant that the emphasis in breeding programs has shifted over the years, but there has been, concomitant with this, a continued improvement in the production traits of both layers and broilers across the various production systems in use.

There is no question that the genetic diversity of chicken resources currently available around the world is enormous in comparison to that presently utilised by the commercial breeders, although there have been only limited studies to characterise the degree and nature of this variation. Dessie *et al.* (2005) reported on ILRI's involvement in this exercise through the Domestic Animal Genetic Resources Information System (DAGRIS). DAGRIS now includes information on 127 breeds/ecotypes of chickens from African and Asian countries, and trait records on 50 of them. It is shortly planned to develop the system to include a component for molecular genetic information which will assist in the determination of the degree of genetic variation between the different breeds and ecotypes.

The present study is aimed at determining the current and projected numbers of indigenous birds cf. hybrid commercial broilers and layers in a number of developing countries, and their relative contribution to chicken meat and egg production and consumption. Because of the very little available data on other poultry species, the study has been restricted to chickens (*Gallus domesticus).*

Accurate estimation of production and/or consumption of products from different genotype groupings of animals depends on good data. In the case of production and consumption of chicken meat and eggs in developing countries, there are very few countries where statistics are available to differentiate between indigenous birds and commercial broilers and layers. In most cases, (e.g. FAOSTAT) data from the different genotype groupings is combined. There would appear to be reasonable estimates of relative numbers of indigenous and commercial hybrid birds in most countries from in-country surveys, but these also frequently suffer from lack of definition, e.g. whether the statistics include species other than chickens, whether young chicks have been included in the indigenous bird number count or whether statistics on broilers have included birds present at a given time or birds produced annually.

Within-country estimates of indigenous bird numbers and productivity

That indigenous breeds of chickens still contribute meaningfully to poultry meat and egg production and consumption in developing countries, is indicated by the reported high proportion (70 - 95%) that these birds make up of each country's total chicken population.(see e.g. NAFRI, 2005 and country reports in ACIAR 2001 and IAEA 2002). Given the low level of productivity of indigenous birds, their relative contribution to meat and egg production, however, is likely to be very much lower than their numerical contribution. As noted above, accurate within-country statistics on genotype specific productivity, are very difficult to obtain. Apart from the practice of combining production data across genotype groups in the compilation of agricultural production statistics, the specific production and consumption of meat and eggs from indigenous chickens in rural areas is very difficult to measure in the absence of detailed surveys. Highly variable mortality from disease and other causes

(Aini, 1990; Spradbrow 1993), variable home consumption of meat and eggs (Alders and Harun, 2004), barter and gifts of chickens and eggs within communities and their use in religious and other ceremonies (Gueye, 1998; Sonaiya *et al.,* 1999; Minga *et al.,* 2001), all contribute to the difficulty in arriving at accurate estimates.

The only statistic for which there is a reasonable body of data from a number of the countries relates to the estimated numbers of indigenous chickens and the proportion these make up of the national flock for a number of countries of Africa and a few countries of Asia. Estimates of indigenous bird numbers and of their proportional contribution to the total flock are provided for some African countries in the ACIAR Proceedings 103 (2001) of a Planning Workshop on Newcastle Disease Control in Village Chickens and in the IAEA (2002) publication "Characteristics and Parameters of family Poultry Production in Africa" arising from an FAO/IAEA coordinated research program. From all sources, there were only two cases (Cameroon and Kenya) where there were estimates of the proportional contribution of indigenous birds to the overall consumption of meat and eggs (50 and 70% respectively). Prediction of production is subject to a high degree of error, but, on the basis of data on flock structure and production, it is possible to derive some very approximate estimates of the relative contribution of these birds to total chicken meat and egg production and consumption.

For many developing countries of Africa and Asia, the estimated proportion of indigenous birds varies between 70 and 95 % with an average close to 80% (e.g. Gueye, 1998; Goodger *et al.,* 2002; NAFRI, 2005). The typical ratio of chicks: growers: adults in scavenging systems in Africa and Asia, has been estimated in a number of studies to range from 2:1:2 (Awuni, 2002), 2:1:1, (Minga *et al.,* 1996), 3:2:2, (NAFRI, 2005) to 1:1:2 (Njue, *et al.,* 2002; Khalafalla *et al.,* 2002). The ratio of adult males to females is typically about 1:3 (e.g. Sonaiya *et al.,* 1999, Bamhare, 2001; Chitate and Guta, 2001; Mavale, 2001; Ekue *et al.,* 2002; NAFRI, 2005). From these studies the average proportion of adult hens in the total indigenous chicken flock including young chicks is thus about 25%. If indigenous birds comprise 80% of the total chicken population, adult indigenous breed hens make up about 20% of the total flock.

These birds lay on average about 40 to 60 eggs per year in three or four clutches (Gueye, 1998; Sonaiya *et al.,* 1999; NAFRI, 2005; Henning *et al*., 2005; country reports in IAEA, 2002 and ACIAR, 2001). Apart from an often low genetic potential, seasonal effects and low levels of nutrition, one important reason for the very low rate of lay in indigenous breed birds is the requirement for the hens to go broody after they have laid a clutch of eggs, to hatch the eggs and rear the chickens. If all the eggs were eaten, their contribution to national egg consumption would be very considerable indeed. However, in most countries and regions, the very large proportion of eggs (>80%, Sonaiya *et al.,* 1999; Ekue *et al.,* 2002; Njue *et al.,* 2002; Khalafalla *et al.,* 2002; Henning *et al.,* 2005) are set under the hen to produce chicks, a large proportion of which regrettably die before 6 weeks of age (Aini, 1990; Cumming 1992; Spradbrow, 1993: Gueye, 1998; Sonaiya *et al.,* Farrell *et al.,* 2000). The above studies report that in a typical clutch of about 10 to 16 eggs, only about 2 to 4 eggs per clutch are kept for consumption or sale. This only amounts to about 6 to 16 eggs per hen per year compared to something like 250 to 300 eggs per hybrid layer hen. Assuming no egg imports, if hybrid layers were to make up about 10% of the total national flock (compared to 20% for local hens), they would contribute something like 92% of the total egg production for consumption or sale, with indigenous hens contributing the remaining 8%.

In considering the contribution to chicken meat consumption and assuming no poultry meat imports, if broilers made up 10% of standing total bird numbers at any given time (in Myanmar the estimate is 4%, Henning *et al,* 2005), with four batches per year, the numbers produced would be equivalent to about 40% of the total bird standing population. Due to high levels of mortality in indigenous chicken flocks, typically only about one male bird per hatch is eaten or sold (Sonaiya *et al.,* 1999; Farrell *et al.,* 2000; Moreki and Masupu, 2001; Bamhare, 2001; Awuni, 2002; Njue *et al.,* 2002, Henning *et al.,* 2005). With four hatches per year, four progeny are eaten/sold per indigenous hen per year. As such, the numbers of indigenous chickens killed for meat production would be equivalent to 80% of the total bird standing population (20% X 4). Thus the contribution of broilers to total chicken meat production (allowing for their greater weight than indigenous chickens ~ 1.5 cf 0.8 kg) would be about 50% by weight and 33% by numbers. The point to this, is that indigenous birds in many developing countries, presently contribute significantly (near to 50%) to total production and consumption of poultry meat, but the actual level of contribution is difficult to estimate accurately.

Relevance to Genetic Conservation

The very large numbers of indigenous breeds/ ecotypes of chickens in the rural regions of most developing countries in Africa and Asia, and the large proportion that they continue to comprise of the total chicken population of each country, suggests that they are not under immediate threat. In some countries, there has been a greater impact of commercial hybrid broilers and layers on overall production than in others. In most countries, however, the retention of significant numbers of indigenous birds in the rural regions has been ensured by their demonstrated capacity to survive and produce under relatively harsh scavenging conditions with very low level inputs, and the preference given to their meat and eggs by the local populace, both in the rural regions and in the cities and towns. By way of contrast, economic production from commercial hybrid birds requires high level inputs in the form of nutrition and housing, which are generally beyond the capacity of poor rural dwellers to provide.. Further, although the meat and eggs produced by indigenous birds are often more expensive in urban and regional markets than those produced (either in-country or imported) by commercial broilers or layers, the latter are still beyond the purchasing power of the rural poor, who continue to rely on their own indigenous birds for subsistence (Gueye, 1998, Sonaiya *et al.* 1999; Henning *et al.,*2005),

A significant number of development programs have been established globally to improve the lot of the rural poor through poultry production. It is the considered opinion of most of the researchers involved in these programs and of the leadership of the various poultry development networks and associations (e.g. INFPD, DNSPD, WPSA, IRPC), that properly managed, indigenous village poultry offer a viable means of alleviating poverty, generating income, achieving food security and empowering women in the poor rural regions of developing countries. For the most part, in the absence of other income generating activities, they do not see this form of production being rapidly replaced by intensive units with commercial hybrid genotypes. The factors mitigating against such replacement are: competition with the large commercial sector; availability and price of stock; quality, price and availability of feed; access to (including distance from) established markets; and restricted local market potential due to price and preference for indigenous chickens.

Undoubtedly, the most cost-efficient means of providing poultry meat and eggs to people living in the cities and towns is through intensive units utilising hybrid commercial genotypes. It is, however, a reality, that many of those who can afford to, prefer to purchase meat and eggs from indigenous birds.

Conclusion

In most developing countries, there is thus a coexistence between a commercial poultry industry based on hybrid genotypes which essentially supplies the majority of the needs of the urban population, and a rural village, mostly scavenging-based industry with genetically diverse indigenous birds, that meets the poultry meat and, to a lesser extent, egg needs of the rural community, as well as a small to moderate proportion of the needs of the urban population. This situation is likely to persist for some time, as notwithstanding improvements in productivity brought about through development projects and the like, subsistence farmers in rural regions will still essentially rely on scavenging indigenous breeds. This will ensure continued genetic diversity in the chicken populations in the majority of developing countries. There is thus potential to exploit this resource in the event of the development of either commercial or government-supported breeding programs aimed at producing birds that are better suited to the prevailing climatic conditions, husbandry practices or market requirements (Jain, 2004).

The study has highlighted the need for much more accurate information on poultry flock structure in developing countries with regard to the numbers of birds within each of the different poultry species and of the numbers and productivity of the various breeds/ecotypes within species as well as a clear definition of the numbers within the various age/ sex groupings.

References

AINI, I. (1990). Indigenous chicken production in South-east Asia. *World's Poultry Science Journal.* **46:** 51-57.

ALDERS, R. and HARUN, M. (2004). Dedicated to working with rural families and their poultry. *Proc 22nd World's Poultry Congress,* Istanbul. Session P5. CD ROM. Abs. p 916.

AWUNI, J.A. (2002). Strategies for the improvement of rural chicken production in Ghana. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Pp. 33-37.

BAMHARE, C. (2001). Country report: Namibia. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 26-31.

BEBAY, C.E. (2005). Tools for effective dialogue with smallholder farmers. *Opportunities for Village Chickens to Assist with Poverty Alleviation with Special Emphasis on the Sustainable Control of Newcastle Disease.* AusAID Southern Africa Disease Control project. ACIAR (In press)

BESBES, B. (2002) Breeding egg type chickens to meet changing demands. *11th European Poultry Conference,* Bremen 6-10 September 2002. CD Rom Proceedings.

BUZA, J.J. and MWAMUHEHE, H.A. (2001). Country report: Tanzania. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 38-42.

CHITATE, F. and GUTA, M. (2001). Country report: Zimbabwe. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 46-50.

CUMMING, R.B. (1992) Newcastle Disease research at the University of New England. *Newcastle Disease in village chickens.* Ed. P. Spradbrow. Proc. 39 ACIAR. Canberra. Pp 84-91.

DESSIE, T. (2005). Delivering systematic information on farm animal genetic resources in developing countries. *Pro. 4th Int. Poult. Seminar.* Dhaka Bangladesh. WPSA Bangladesh. Pp 190-195.

DLAMINI, T. (2001). Country report: Swaziland. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 36-37.

EKUE, F.N., PONE, K.D., MAFENI, M.J., NFI, A.N. and NJOYA, J. (2002). Survey of the traditional poultry production system in the Barmenda area, Cameroon. In: Characteristics and Parameters of family Poultry Production in Africa. IAEA. Vienna. Pp. 15-25.

FARRELL, D.J., BAGUST, T.J., PYM, R.A.E. and SHELDON, B.L. (2000). Strategies for improving the production of scavenging chickens. *Asian-Aus J. Anim. Sci.* **13:** Supplement Pp 79-85.

FOURIE, H.J., SWATSON, H.K., GROBBELAAR, J.A.N., MOLALAKGOTLA, M.N. and JOOSTEN, F.A. (2004). Fowls for Africa. *XXII World's Poultry Congress,* Istanbul, June 8-13, 2004. CD ROM Proceedings.

GOODGER, W.J., BENNETT, T.B. and DWINGER, R.H. (2002). Comparative analysis of family poultry production in twelve African countries. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Vienna. Pp. 33-37.

GUEYE, E.H.F. (1998) Village egg and fowl meat production in Africa. *WPSJ* **54:** 73-86.

HENNING, J., MEERS, J. PYM, R., MORTON, J. and THAN HLA. (2005) Village chicken production in Myanmar: Characteristics, constraints and methods for improving the health of village chickens. In: *Opportunities for Village Chickens to Assist with Poverty Alleviation with Special Emphasis on the Sustainable Control of Newcastle Disease.* AusAID Southern Africa Disease Control project. ACIAR (In press)

HOFFMANN, I. (2005). Research and investment in poultry genetic resources – challenges and options for sustainable use. *World's Poultry Science Journal*. **61:** 57-70.

HORST, P. (1988). Native fowl as a reservoir for genomes and major genes with direct and indirect effects on productive adaptability. *Proc. 18th World's Poultry Cong.* Japan Pp 99-104

HUQUE, Q.M. (2002). People fight poverty with poultry: Strategies for family poultry in developing countries. *Proc. 7th WPSA Asian Pacific Fed. Conf.,* Gold Coast, Australia. Pp 565-572.

JAIN, G. (2004). Breeding for special needs of developing countries in collaboration with international companies. *Proc 22nd World's Poultry Congress,* Istanbul. Plenary session 1. CD ROM. Abs. p 86.

JUGESSUR, V.S. and SEENEVASSEN PILLAY, M.M. (2002). Family Poultry production in Mauritius: Problems and prospects. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Vienna. Pp. 65-71.

KAMPENI, F.L. (2001). Country report: Malawi. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 15-16.

KOKO, M., MAMINIAINA, O.F., RAVAOMANANA, J. and RAKOTONINRINA, S.J. (2002). Village poultry production in Madagascar: Production characteristics and epidemiology. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Pp. 47-63.

KHALAFALLA, A.I., AWAD, S. and HASS, W. (2002). Village poultry production in the Sudan. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Pp. 87-93.

KYARISIIMA, C.C. and BAFASHA, S. (2005). Effect of feeding regime during the starting phase on performance of growing village chickens. In: *Opportunities for Village Chickens to Assist with Poverty Alleviation with Special Emphasis on the Sustainable Control of Newcastle Disease.* AusAID Southern Africa Disease Control project. ACIAR (In press)

MAVALE, A.P. (2001). Country report: Mozambique. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 20-25.

McKAY, J.C., McADAM, J., KOERHUIS, A.N.M. and BARTON, N.F. (2002) Breeding meat- type chickens for changing demands. *11th European Poultry Conference,* Bremen 6-10 September 2002. CD Rom Proceedings.

MINGA, U.M., KATULE, A.M., YONGOLO, M.G.S. and MWANJALA, T. (1996). The rural chicken industry in Tanzania: Does it make sense? In: *Proc. Tanzania Veterinary Assoc. Scientific Conference,* **16:** 25-28.

MINGA, U.M., MSOFFE, P.L. and GWAKISA, P.S. (2004). Biodiversity (variation) in disease resistance and in pathogens within rural chickens. 22nd World's Poultry Congress June 8-12 Istanbul- CD Proceedings.

MOREKI, J.C. and MASUPU, K.V. (2001). Country report: Botswana. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 5-10.

NAFRI (2005) Indigenous chicken and rural livelihoods in LAO PDR. NAFRI Report. 10 Pp.

NJUE, S.W., KASIITI, J.L., MACHARIA, M.J., GACHERU, S.G. and MBUGUA, H.C.W. (2002). Health and management improvements of family poultry production in Africa- Survey results from Kenya. In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Vienna. Pp. 39-45.

NQINDI, J. (2002). Improvement of health and management of family poultry production in Zimbabwe In: *Characteristics and Parameters of family Poultry Production in Africa*. IAEA. Vienna. Pp. 137-142.

SAFALAOH, C.L.A. and SANKHULANI. F.G. (2004). Crossbreeding as a strategy to improve productivity of indigenous chickens in Malawi. *Proc 22nd World's Poultry Congress,* Istanbul. Session P5. CD ROM. Abs. p 896.

SCHERF, B. (ed. 2000). World Watch List for domestic animal diversity, 3rd edn. Part 1.9 http://dad.fao.org/en/Home.htm - databases. Rome, Italy: FAO/UNDP.

SHAVER, D.M. (2000). Welcome Address Opening Ceremony. *21st World's Poultry Congress, Montreal.*. CD ROM proceedings

SONAIYA, E.B., BRANCKAERT, R.D.S. and GUEYE, E.F. (1999). Research and development options for family poultry. *First INFPD/FAO Electronic Conference on Family Poultry.* December 7 1998 – March 5 1999. Introductory paper.

SONGOLO, A. and KATONGO, J.C. (2001). Country report: Zambia. In: *SADC Planning Workshop on Newcastle Disease Control in Village Chickens.* Maputo, Mozambique, March 2000. Eds R.G. Alders and P.B. Spradbrow. ACIAR Proceedings 103. Pp. 43-45.

SPRADBROW, P.B. (1993). Newcastle Disease in village chickens. Poultry Science Rev. **5:** 57-96.